

Consumer Focussed Power System Operations

Australia's energy system is continuing its rapid transition from one built around large-scale centralised generation, to a decentralised system consisting of residential resources, most notably today rooftop solar PV.

Today, the National Electricity Market (NEM) has more than 14 gigawatts (GW) of rooftop solar installed, 23% of total generation capacity. This is forecast to grow to 23 GW by 2025. This growing dominance of rooftop solar PV means new tools are required by AEMO and powerline owners to keep the power system secure. Existing capabilities do not provide the functionality required.

Context

Extensive work is underway to better integrate rooftop solar and other Distributed Energy Resources (DER) into markets and the power system. The Energy Security Board's post-2025 program is designing new market frameworks so consumers can fully harness the value and capabilities of their DER, alongside work by distribution networks to dynamically operate rooftop solar to enable more solar export.

This transition must be carefully managed. Current technical capabilities are not yet sufficient for rare and challenging operating conditions that correlate with high export from Australia's world-leading volumes of rooftop solar PV, creating unintended risks to the secure and reliable supply of electricity. This includes [minimum system load](#) periods when a surplus of supply from distributed resources is displacing large-scale dispatchable generation and the essential services it provides to securely operate the grid. In these periods there are also risks of DPV unexpectedly disconnecting in large volumes at the same time as a large generator, risking system security.

AEMO's goal is to be capable of operating a power system with periods of 100% renewables. In order to achieve this, just as today there are last resort tools to manage a lack of supply, tools will be required to manage a surplus of supply.

Market & operational improvements

As part of AEMO's role to manage the real-time operations of the power system, AEMO will implement a notification process and operating framework to minimise power system risks while supporting future solutions as they are being developed, including those in the ESB post-2025 reforms. Three Market Notices may be issued if minimum system load or rooftop solar and large-scale generator disconnection risks emerge:

1. Forecast potential Contingency or Minimum System Load event and seeking a market response.
2. Advise action has been taken to maintain system security, such as recalling planned transmission maintenance outages, increasing electricity demand by directing scheduled load into service or curtailing large-scale generation. If these measures are not sufficient then as a last resort, an instruction may be issued to maintain demand or rooftop solar within secure thresholds which could result in curtailment of small-scale solar PV.
3. Notify that curtailment of rooftop solar PV is occurring as a last resort because preceding actions have not been sufficient to maintain power system security.

This new 3-stage operating framework is adding a stage 1 notification to the market, to signal to market participants for voluntary 'consumer side' or other measures that could be available attempting to avoid the need for stages 2 or 3. Where possible, the market signal will be issued a day in advance where challenging operating

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conditions are forecast to provide the market time to prepare and respond, but it could also be issued quite quickly or not at all where unexpected conditions and time constraints arise.

The stage 3 'emergency backstop' has only been utilised once on 14 March this year when SA was at credible risk of separation due to a major transmission line outage. The emergency backstop capability is currently only available in South Australia due to its world leading level of rooftop solar. In this event, AEMO first considered what other operational measures could be taken, before instructing SA Power Networks via ElectraNet. Every action possible is taken before any measures that may impact rooftop solar.

Wherever possible and effective, large scale generators are curtailed as much as possible, and all other actions are taken before there is any instruction by AEMO which could result in rooftop solar being impacted.

The emergency backstop capability was implemented quite rapidly and AEMO, ElectraNet and SA Power Networks have always committed to improving how this last resort tool functions.

Consumer focussed transition

Consumer-side markets are emerging at present, and improvements are underway under the Energy Security Board's Post 2025 reforms to further enhance them. The market signals provided by this new framework will help these markets emerge while also providing real-time information regarding actions taken to keep the power system secure.

Almost 80% of demand is forecast at times to be supplied by rooftop solar PV by 2025. To manage this growth distribution networks alongside the ESB's market reforms are exploring ways of actively managing DER in real-time, which will allow existing export caps to be removed or reduced and consumers to install bigger systems and more rooftop solar PV. These types of systems can be slightly curtailed during periods of peak export while being free to generate more during 'off-peak' periods, in total allowing consumers to export more to the grid. This dynamic management capability is being rolled out by SA Power Networks and is under consideration or development by most other distribution networks.

The market notices model will also be applied in other jurisdictions if they implement emergency backstop capabilities as per the Energy Security Board's recommendation. The impact on each customer's feed-in tariff is expected to be no more than a few dollars or less per event, with these events occurring very rarely. The benefits to the wider community are significant, mitigating system security risks and reducing potential for widespread blackouts, and increasing the power system's ability to continue to support new solar installations.

AEMO does not take these steps lightly but just as occurs today with last resort load shedding measures when all other 'market' and 'standard' system operating tools have been unable to keep the power system secure, it is important that emergency operating tools are available to avoid system security issues that risk state-wide outages, which have a far greater impact on consumers.